Perspectives on multi-scale and time-resolved 3D imaging of pore scale processes in geomaterials

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ABSTRACT

The study of transport and degradation processes in porous geo-materials bears importance to a variety of real-world problems, both in underground as above ground. To fully comprehend the impact these processes have on large geological entities, it is crucial to understand what happens on the pore scale level, for example to use this understanding as input to larger scale models.
Over the past decade, the availability of high quality laboratory-based X-ray micro-computed tomography (micro-CT) scanners has enabled many researchers to image and analyze a geo-material's pore space in 3D. However, a number of important challenges in both the acquisition and the analysis of 3D pore space information persists. On the one hand, specialized imaging, analysis and modeling techniques are needed to deal with the multi-scale aspect of many geo-materials. On the other hand, understanding the dynamics of pore-scale processes requires in-situ, time-resolved imaging. We will present the progress on these two key issues at Ghent University's Centre for X-Ray Tomography (UGCT). As an approach to tackle the multi-scale problem, we will show results from new complementary high-resolution imaging techniques (e.g. ptychographic tomography). With regard to the challenge of time-resolved imaging, we will demonstrate our advances in (fast) in-situ, lab-based micro-CT imaging of transport and degradation processes in porous geo-materials (e.g. two-phase flow, salt crystallization, reactive flow).

GRAPHICS